



# AEC-NASA TECH BRIEF



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## Evaluation of Methods for Nondestructive Testing of Brazed Joints

A study was initiated to compare and evaluate the three major nondestructive methods of testing brazed joints: X-ray radiography, neutron radiography, and ultrasonic testing. Because of the wide variety of base materials, brazing alloys, and brazing methods, no single method has appeared to supply all desired inspection information.

The strength of a brazed joint depends upon such factors as defects inside the joint, the type of alloy formed between base metal and braze alloy, and the clearance of the brazed parts.

The most favorable clearance is 0.0254 mm for Easy Flow-type brazing alloys, and less than 0.0254 mm for Microbrazing-type alloys. This clearance setting is related to the alloy tensile strength. If the clearance is favorable for a particular alloy, the tensile strength can be several times higher than the brazing alloy strength itself under a three-dimensional force. Therefore, this study of nondestructive method effectiveness was made on samples having a 0.0254-mm clearance between the parts joined.

Brazing alloys, containing thermal neutron attenuating elements such as boron, silver, and cadmium, were used for the evaluation. ASTM 304 stainless steel generally served as the base metal.

Artificial brazing faults were introduced by making holes of various specified diameters through brazing alloy foils, which were then sandwiched between the base metals. The radiographs of real brazed parts were compared with those of the artificial faults and also with photomicrographs of brazed samples.

The results of ultrasonic testing, recorded on electro-sensitive paper in two dimensions or pen recorded, were also compared with these radiographs and with photomicrographs. In general, the ultrasonic methods were found to be effective in the detection of

nonbonds in diffusion bonded samples. However, defect resolution was a problem, particularly near edges of the samples. Radiography provided excellent resolutions of void or inclusion defects, with the neutron radiographic technique showing particular advantage for brazing materials containing cadmium.

The test methods and detailed results of this study are contained in: *The Nondestructive Testing of Brazed Joints*, by Akira Kannō, ANL-6924, Argonne National Laboratory, Argonne, Illinois, November 1964. This report is available from the Clearinghouse for Federal Scientific and Technical Information, Springfield, Virginia 22151; price \$3.00; microfiche \$0.65.

### Notes:

1. This information may be of interest to manufacturers and users of nondestructive testing equipment.
2. Inquiries concerning this innovation may be directed to:

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### Patent status:

Inquiries about obtaining rights for commercial use of this innovation may be made to:

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Chicago Patent Group  
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Category 03